

REMARKS

In accordance with the foregoing, claim 1 has been amended. Claims 1-15 are pending. The examiner indicates that claims 1-4, 7, 8 and 12-15 are under consideration. As described below, applicants believed that claims 6 and 11 should also be under consideration. In the foregoing claim amendments, claims 6 and 11 are indicated as being "previously presented" instead of "withdrawn."

(I) Amendment to the claims

In order to more clearly define the present invention, the Applicants have instantly amended claim 1 so that the polymer block S recited therein is limited to one which has a vinyl bond content of from 5 % to less than 40 % as measured with respect to conjugated diene monomer units. Support for this amendment is found at page 32, lines 4-10 of the present specification.

(II) The state of the art and the essential features and advantages of the present invention

Before specifically addressing the Examiner's objection and rejections in the outstanding Office Action, it is believed that the following background information should be considered in order to shed a proper light on the development of the present invention and the advantageous features thereof.

As described in the present specification under "Prior Art", with respect to a shaped article containing a hydrogenated copolymer which is obtained by hydrogenating an unhydrogenated copolymer comprising vinyl aromatic monomer units and conjugated diene monomer units, it is desired to impart thereto flexibility, low temperature characteristics (such as flexibility at low temperatures) and shock-absorbing property (low impact resilience), so that the shaped article can be advantageously used as a shock-absorber or the like.

In this situation, the present inventors have made extensive and intensive studies with a view toward developing a shaped article containing the above-mentioned hydrogenated copolymer, wherein the shaped article exhibits excellent properties with respect to flexibility, low temperature characteristics (such as flexibility at low temperatures) and shock-absorbing property (low impact resilience). As a result, it has unexpectedly been found that such an excellent shaped article can be realized by a polymer foam as defined in instantly amended claim 1 of the present application. For easy reference, instantly amended claim 1 of the present application is reproduced below.

"1. A polymer foam comprising a plurality of cells defined by cell walls which constitute a polymer matrix,

said polymer matrix being comprised of:

5 to 100 parts by weight, relative to 100 parts by weight of the total of components (A) and (B), of (A) a hydrogenated copolymer obtained by hydrogenating an unhydrogenated copolymer comprising vinyl aromatic monomer units and conjugated diene monomer units, said unhydrogenated copolymer containing at least one copolymer block S which is comprised of vinyl aromatic monomer units and conjugated diene monomer units and which has a vinyl bond content of from 5 % to less than 40 % as measured with respect to conjugated diene monomer units, and

95 to 0 part by weight, relative to 100 parts by weight of the total of components (A) and (B), of (B) at least one polymer selected from the group consisting of an olefin polymer other than said hydrogenated copolymer (A) and a rubbery polymer other than said hydrogenated copolymer (A),

said hydrogenated copolymer (A) having the following characteristics (1) and (2):

(1) said hydrogenated copolymer (A) has a content of said vinyl aromatic monomer units of from more than 40 % by weight to 60 % by weight, based on the weight of said hydrogenated copolymer (A), and

(2) at least one peak of loss tangent ($\tan\delta$) is observed at $-40\text{ }^{\circ}\text{C}$ to lower than $-10\text{ }^{\circ}\text{C}$ in a dynamic viscoelastic spectrum obtained with respect to said hydrogenated copolymer (A),

said polymer foam having a specific gravity of from 0.05 to 0.5."

As seen from instantly amended claim 1 reproduced above, the polymer foam of the present invention contains a hydrogenated copolymer (A) obtained by hydrogenating an unhydrogenated copolymer comprising vinyl aromatic monomer units and conjugated diene monomer units, wherein the unhydrogenated copolymer contains at least one specific copolymer block S. The hydrogenated copolymer (A) has the following important features (I), (II) and (III):

(I) The copolymer block S (contained in the unhydrogenated copolymer from which the hydrogenated copolymer (A) is obtained by hydrogenation) is comprised of vinyl aromatic monomer units and conjugated diene monomer units and has a vinyl bond content of from 5 % to less than 40 % as measured with respect to conjugated diene monomer units.

(II) The hydrogenated copolymer (A) has a content of the vinyl aromatic monomer units of from more than 40 % by weight to 60 % by weight, based on the weight of the hydrogenated copolymer (A).

(III) At least one peak of loss tangent ($\tan\delta$) is observed at $-40\text{ }^{\circ}\text{C}$ to lower than $-10\text{ }^{\circ}\text{C}$ in a dynamic viscoelastic spectrum obtained with respect to the hydrogenated copolymer (A).

By virtue of the above-mentioned features (I) to (III), the polymer foam of the present invention exhibits excellent properties with respect to flexibility, low temperature characteristics (such as flexibility at low temperatures) and shock-absorbing property (low impact resilience). On this point, a detailed explanation is given below.

Feature (I) (i.e., the feature that the polymer block S is comprised of vinyl aromatic monomer units and conjugated diene monomer units and has a vinyl bond content of from 5 % to less than 40 % as measured with respect to conjugated diene monomer units) is important for enhancing the shock-absorbing property (low impact resilience) of the polymer foam. This is suggested from the following description of the present specification:

"With respect to the vinyl bond content of the conjugated diene monomer units of the copolymer block comprised of vinyl aromatic monomer units and conjugated diene monomer units in the base unhydrogenated copolymer, there is no particular limitation; however, it is preferred that the vinyl bond content is from 5 % to less than 40 % (hereinafter, the vinyl bond content means the total content of the 1,2-vinyl bond and 3,4-vinyl bond with the proviso that, when only 1,3-butadiene is used as the conjugated diene monomer, the vinyl bond content means the content of the 1,2-vinyl bond). From the viewpoint of the low impact resilience and handling property (anti-blocking property) of the polymer foam, the vinyl bond content is more preferably from 5 to 35 %, still more preferably from 8 to 30 %, still more preferably from 10 to 25 %." (emphasis added) (see page 32, lines 4-19 of the present specification)

Also, feature (II) (i.e., the feature that the hydrogenated copolymer (A) has a content of the vinyl aromatic monomer units of from more than 40 % by weight to 60 % by weight, based on the weight of the hydrogenated copolymer (A)) is important for enhancing the polymer foam with respect to flexibility and shock-absorbing property (low impact resilience). This is suggested from the following description of the present specification:

"The content of the vinyl aromatic monomer units in the hydrogenated copolymer (A) is from more than 40 % by weight to 60 % by weight, based on the weight of the hydrogenated copolymer (A). From the viewpoint of flexibility and shock-absorbing property, the content of the vinyl aromatic monomer units in the hydrogenated copolymer (A) is preferably from 43 to 57 %"

by weight, more preferably from 45 to 55 % by weight." (emphasis added) (see page 19, line 18 to page 20, line 1 of the present specification)

Further, feature (III) (i.e., the feature that at least one peak of loss tangent ($\tan\delta$) is observed at $-40\text{ }^{\circ}\text{C}$ to lower than $-10\text{ }^{\circ}\text{C}$ in a dynamic viscoelastic spectrum obtained with respect to the hydrogenated copolymer (A)) is essential for achieving a good balance of flexibility, low temperature characteristics (such as flexibility at low temperatures) and shock-absorbing property (low impact resilience) in the polymer foam. This is apparent from the following description of the present specification:

"The presence of at least one peak of loss tangent in the range of from $-40\text{ }^{\circ}\text{C}$ to lower than $-10\text{ }^{\circ}\text{C}$ is essential for achieving a good balance of flexibility, low temperature characteristics and shock-absorbing property (low impact resilience) in the polymer foam." (see page 20, line 24 to page 21, line 4 of the present specification)

The effects of the polymer foam of the present invention, which are achieved by the use of the hydrogenated copolymer (A) having the above-mentioned features (I) to (III), are substantiated in the working examples (i.e., Examples 1-8) of the present application. On this point, a detailed explanation is given below.

In Examples 1-8 of the present application, polymer foams containing hydrogenated copolymers are produced, and the properties of the polymer foams are measured and evaluated (see page 98, lines 10 to page 103, line 8 of the present specification; and Table 1 appearing at page 104 of the present specification). As the hydrogenated copolymers, polymers 1 to 4 are used in Examples 1-8 (the characteristics of polymers 1 to 4 are explained below). Specifically, Examples 1, 2, 4, 5 and 6 use polymer 1 (see Table 1 appearing at page 104 of the present specification; and page 101, line 22 to page 102, line 13 of the present specification); Example 3 uses polymer 2 (see Table 1 appearing at page 104 of the present specification); Example 7 uses polymer 3 (see page 102, lines 15-23 of the present specification); and Example 8 uses polymer 4 (see page 102, line 25 to page 103, line 8 of the present specification).

The characteristics of polymers 1 to 4 are described at page 89, line 2 to page 95, line 7 of the present specification. Based on this description, the characteristics of polymers 1 to 4 are explained below.

Polymer 1 is a hydrogenated copolymer which is obtained by hydrogenating an unhydrogenated block copolymer having a block configuration H-S-H, wherein each H independently represents a styrene polymer block and S represents a styrene/butadiene copolymer block (see page 89, line 3 to page 91, line 14 of the present specification). The copolymer block S has a vinyl bond content of 20 % as measured with respect to butadiene

monomer units (see page 90, lines 18-21 of the present specification). Also, polymer 1 has a styrene monomer unit (vinyl aromatic monomer unit) content of 52 % by weight (see page 90, lines 16-17 of the present specification). (In this connection, it should be that, as described at page 20, lines 2-9 of the present specification, the content of the vinyl aromatic monomer units in the hydrogenated copolymer is approximately equal to the content of the vinyl aromatic monomer units in the unhydrogenated copolymer and, therefore, the content of the vinyl aromatic monomer units in the unhydrogenated copolymer is used as the content of the vinyl aromatic monomer units in the hydrogenated copolymer.) Further, in a dynamic viscoelastic spectrum obtained with respect to polymer 1, a peak of loss tangent ($\tan\delta$) is observed at $-15\text{ }^{\circ}\text{C}$ (see page 91, lines 16-18 of the present specification).

Polymer 2 is a hydrogenated copolymer which is obtained by hydrogenating an unhydrogenated block copolymer having a block configuration H-S-H, wherein each H independently represents a styrene polymer block and S represents a styrene/butadiene copolymer block (see page 91, line 24 to page 92, line 24 of the present specification). The copolymer block S has a vinyl bond content of 22 % as measured with respect to butadiene monomer units (see page 92, lines 15-18 of the present specification). Also, polymer 2 has a styrene monomer unit (vinyl aromatic monomer unit) content of 46 % by weight (see page 92, lines 14-15 of the present specification). (In this connection, it should be that, as described at page 20, lines 2-9 of the present specification, the content of the vinyl aromatic monomer units in the hydrogenated copolymer is approximately equal to the content of the vinyl aromatic monomer units in the unhydrogenated copolymer and, therefore, the content of the vinyl aromatic monomer units in the unhydrogenated copolymer is used as the content of the vinyl aromatic monomer units in the hydrogenated copolymer.) Further, in a dynamic viscoelastic spectrum obtained with respect to polymer 2, a peak of loss tangent ($\tan\delta$) is observed at $-25\text{ }^{\circ}\text{C}$ (see page 93, lines 1-3 of the present specification).

Polymer 3 is obtained in substantially the same manner as in the production of polymer 1, except that modification is performed before hydrogenation (see page 93, line 9 to page 94, line 8 of the present specification). Therefore, the unhydrogenated block copolymer used for producing polymer 3 has a block configuration H-S-H, wherein each H independently represents a styrene polymer block and S represents a styrene/butadiene copolymer block. Also, the copolymer block S has a vinyl bond content of 20 % as measured with respect to butadiene monomer units. Further, polymer 3 has a styrene monomer unit (vinyl aromatic monomer unit) content of 52 % by weight.

Moreover, in a dynamic viscoelastic spectrum obtained with respect to polymer 3, a peak of loss tangent ($\tan\delta$) is observed at -15 °C (see page 94, lines 10-12 of the present specification).

Polymer 4 is obtained by further modifying polymer 3 (which, as mentioned above, is a modified, hydrogenated copolymer) (see page 94, line 18 to page 95, line 1 of the present specification). Therefore, the unhydrogenated copolymer used for producing polymer 4 has a block configuration H-S-H, wherein each H independently represents a styrene polymer block and S represents a styrene/butadiene copolymer block. Also, the copolymer block S has a vinyl bond content of 20 % as measured with respect to butadiene monomer units. Further, polymer 4 has a styrene monomer unit (vinyl aromatic monomer unit) content of 52 % by weight.

Moreover, in a dynamic viscoelastic spectrum obtained with respect to polymer 4, a peak of loss tangent ($\tan\delta$) is observed at -15 °C (see page 95, lines 2-4 of the present specification).

From the above-mentioned explanation on the characteristics of polymers 1 to 4, the following Table A is obtained.

Table A

	Block configuration	Vinyl bond content (%)	Styrene monomer unit content (wt. %)	Peak of loss tangent (°C)
1	Polymer H-S-H	20	52	-15
2	Polymer H-S-H	22	46	-25
3	Polymer H-S-H	20	52	-15
4	Polymer H-S-H	20	52	-15

Notes:

(1) "Block configuration" means the block configuration of the unhydrogenated block copolymer used for producing the hydrogenated copolymer. In these block configurations, each H independently represents a styrene polymer block and each S independently represents a styrene/butadiene copolymer block.

(2) "Vinyl bond content" means the vinyl bond content of the copolymer block S (as measured with respect to butadiene monomer units) contained in the unhydrogenated block copolymer.

As seen from Table A above, all of polymers 1 to 4 satisfy all of the above-mentioned features (I) to (III). Specifically, the copolymer block S (styrene/butadiene copolymer block) contained in the unhydrogenated block copolymer used for producing polymer 1, 2, 3 or 4 has a vinyl bond content of from 20 to 22 % as measured with respect to butadiene monomer units, which is within the range (from 5 % to less than 40 %) recited in feature (I). Also, each of polymers 1 to 4 has a styrene monomer unit (vinyl aromatic monomer unit) content of from 46 to 52 % by weight, which is within the range (from more than 40 % by weight to 60 % by weight) recited in feature (II). Further, in a dynamic viscoelastic spectrum obtained with respect to polymer 1, 2, 3 or 4, a peak of loss tangent ($\tan\delta$) is observed at a temperature of from -25 to -15 °C, which is within the range (from -40 °C to lower than -10 °C) recited in feature (III).

By the use of such hydrogenated copolymers having features (I) to (III), the polymer foams produced in Examples 1-8 have excellent properties, as explained below.

As shown in Table 1 appearing at page 104 of the present specification, the polymer foams produced in Examples 1-5 exhibit excellent properties with respect to flexibility, low temperature characteristics (such as flexibility at low temperatures) and shock-absorbing property (low impact resilience).

Also, the polymer foams produced in Examples 6-8 have excellent properties as comparable to those of the polymer foam obtained in Example 1 (see page 102, lines 11-13 and 21-23, and page 103, lines 6-8 of the present specification). Therefore, the polymer foams produced in Examples 6-8 exhibit excellent properties with respect to flexibility, low temperature characteristics (such as flexibility at low temperatures) and shock-absorbing property (low impact resilience).

As apparent from the above, the working examples (i.e., Examples 1-8) of the present application show that, by virtue of the hydrogenated copolymer having (A) the above-mentioned features (I) to (III), there can be obtained a polymer foam having excellent properties with respect to all of flexibility, low temperature characteristics (such as flexibility at low temperatures) and shock-absorbing property (low impact resilience).

In this connection, it should be noted that such an excellent polymer foam cannot be obtained if a hydrogenated copolymer having the above-mentioned features (I) to (III) is not used. On this point, an explanation is given below, with reference to Comparative Example 1 of the present application.

In Comparative Example 1, a polymer foam is produced without use of a hydrogenated copolymer having the above-mentioned features (I) to (III) (see page 103, lines 11-18 of the present specification; and Table 1 appearing at page 104 of the present specification).

As shown in Table 1 appearing at page 104 of the present specification, the polymer foam obtained in Comparative Example 1 has poor properties with respect to low temperature characteristics (such as flexibility at low temperatures). Specifically, the polymer foam obtained in Comparative Example 1 exhibits a hardness of 69 at a temperature of -10 °C, which is very high as compared to the values (from 47 to 56) obtained with respect to the polymer foams produced in Examples 1-5. This shows that the polymer foam obtained in Comparative Example 1 has poor flexibility at -10 °C as compared to the case of any of the polymer foams of Examples 1-5.

(III) Election/Restrictions

Hereinbelow, the Applicants make traverse against the Examiner's objections and rejections.

The Examiner has withdrawn claims 6 and 11 from consideration (see item 1 appearing at page 2 of the outstanding Office Action). However, the Examiner's reasoning for his withdrawal of claims 6 and 11 is not persuasive, as explained below.

With respect to claim 6

The Examiner has withdrawn claim 6 from consideration for the reason that the Applicants previously elected Species A1 in category A (composition of unhydrogenated copolymer) and that Species A1 does not encompass a block copolymer of formula (6) (i.e., H-S-H) recited in claim 6. However, the Examiner's reasoning for his withdrawal of claim 6 is not persuasive, as explained below.

In the Office Action dated October 13, 2006, the Examiner defines Species A1 as "copolymer block S, as set forth in claim 1" (emphasis added) (see page 2 of the Office Action dated October 13, 2006). From the Examiner's definition of Species A1, the Applicants understand that Species A1 represents an unhydrogenated copolymer as recited in claim 1, that is, an unhydrogenated copolymer which contains at least one copolymer block S. Therefore, Species A1 encompasses all of the block copolymers recited in claim 6, including a block copolymer of formula (1) (i.e., S) and a block copolymer of formula (6) (i.e., H-S-H).

Also, in the Office Action dated March 19, 2007, the Examiner states that “since claim 6 recites various copolymer species, including restricted species S-H (claim 5), additional species election in Category A becomes necessary as set forth below” and “Please elect one of the species listed in claims 1 and 6” (see page 2 of the Office Action dated March 19, 2007). This statement of the Examiner confirms that Species A1 encompasses all of the block copolymers recited in claim 6, because, if Species A1 encompassed only a copolymer S (i.e., a copolymer consisting of only one block S), a further election as requested by the Examiner would be meaningless.

On the basis of the above understanding that Species A1 encompasses all of the block copolymers recited in claim 6, the Applicants elected a block copolymer of formula (6) (i.e., H-S-H) as the species of Category A in the previous response of April 19, 2007.

Thus, the Applicants request the Examiner not to withdraw claim 6 from consideration.

With respect to claim 11

The Examiner has withdrawn claim 11 from consideration for the reason that the Applicants’ previously elected species in Category D (composition of component (B)) is not readable on claim 11. However, the Examiner’s reasoning for his withdrawal of claim 11 is not persuasive, as explained below.

As the Examiner understands, the Applicants previously elected “a hydrogenation product of a block copolymer comprised of a homopolymer block of vinyl aromatic monomer units and at least one polymer block selected from the group consisting of a homopolymer block of conjugated diene monomer units and a copolymer block comprised of vinyl aromatic monomer units and conjugated diene monomer units” in Category A. This species is actually recited in claim 11, as explained below.

Claim 11 reads as follows:

“11. The polymer foam according to claim 1 or 2, wherein said rubbery polymer as component (B) is at least one member selected from the group consisting of a 1,2-polybutadiene, a hydrogenation product of a conjugated diene homopolymer, a copolymer comprised of vinyl aromatic monomer units and conjugated diene monomer units and a hydrogenation product thereof, a block copolymer comprised of a homopolymer block of vinyl aromatic monomer units and at least one polymer block selected from the group consisting of a homopolymer block of conjugated diene monomer units and a copolymer block comprised of vinyl aromatic monomer units and conjugated diene monomer units and a hydrogenation product

thereof, an acrylonitrile/butadiene rubber and a hydrogenation product thereof, an ethylene/propylene/diene rubber (EPDM), a butyl rubber and a natural rubber.” (emphasis added)

From the context of claim 11 reproduced above, it is apparent that the compound emphasized by underlining, i.e., “a hydrogenation product thereof”, means “a hydrogenation product of a block copolymer comprised of a homopolymer block of vinyl aromatic monomer units and at least one polymer block selected from the group consisting of a homopolymer block of conjugated diene monomer units and a copolymer block comprised of vinyl aromatic monomer units and conjugated diene monomer units”. This compound is the same as the above-mentioned compound which the Applicants previously elected as the species in Category A.

Thus, the Applicants request the Examiner not to withdraw claim 11 from consideration.

(IV) Objection to claim 12 under 37 CFR 1.75(c)

Claim 12 is objected to under 37 CFR 1.75(c) as being of improper dependent form for failing to further limit the subject matter of a previous claim (see item 2 appearing at pages 2-3 of the outstanding Office Action). More specifically, the Examiner states that claim 12 is “improperly dependent upon claim 11, because none of the Markush group member of claim 12 is found to be further limiting species of any of Markush group member in claim 11”. However, as explained below, the Examiner’s opinion is not correct.

Claim 12 reads as follows:

“12. The polymer foam according to claim 11, wherein said rubbery polymer as component (B) is at least one member selected from the group consisting of a hydrogenation product of a copolymer comprised of vinyl aromatic monomer units and conjugated diene monomer units, said hydrogenation product having a vinyl aromatic monomer unit content of from more than 60 % by weight to 90 % by weight, based on the weight of said hydrogenation product; and a block copolymer comprised of a homopolymer block of vinyl aromatic monomer units and at least one polymer block selected from the group consisting of a homopolymer block of conjugated diene monomer units and a copolymer block comprised of vinyl aromatic monomer units and conjugated diene monomer units and a hydrogenation product thereof.”

As seen from the above-reproduced description of claim 12, the Markush group members of claim 12 are the following three compounds (1), (2) and (3):

(1) A hydrogenation product of a copolymer comprised of vinyl aromatic monomer units and conjugated diene monomer units, said hydrogenation product having a vinyl aromatic monomer unit content of from more than 60 % by weight to 90 % by weight, based on the weight of said hydrogenation product.

(2) A block copolymer comprised of a homopolymer block of vinyl aromatic monomer units and at least one polymer block selected from the group consisting of a homopolymer block of conjugated diene monomer units and a copolymer block comprised of vinyl aromatic monomer units and conjugated diene monomer units.

(3) A hydrogenation product of a block copolymer comprised of a homopolymer block of vinyl aromatic monomer units and at least one polymer block selected from the group consisting of a homopolymer block of conjugated diene monomer units and a copolymer block comprised of vinyl aromatic monomer units and conjugated diene monomer units. (The compound (3) is the same as “a hydrogenation product thereof” recited in the last line of claim 12.)

The compound (1) above is a limitation to “a hydrogenation product of a copolymer comprised of vinyl aromatic monomer units and conjugated diene monomer units”, which is recited in claim 11. In order to show this, claim 11 is reproduced below again:

“11. The polymer foam according to claim 1 or 2, wherein said rubbery polymer as component (B) is at least one member selected from the group consisting of a 1,2-polybutadiene, a hydrogenation product of a conjugated diene homopolymer, a copolymer comprised of vinyl aromatic monomer units and conjugated diene monomer units and a hydrogenation product thereof, a block copolymer comprised of a homopolymer block of vinyl aromatic monomer units and at least one polymer block selected from the group consisting of a homopolymer block of conjugated diene monomer units and a copolymer block comprised of vinyl aromatic monomer units and conjugated diene monomer units and a hydrogenation product thereof, an acrylonitrile/butadiene rubber and a hydrogenation product thereof, an ethylene/propylene/diene rubber (EPDM), a butyl rubber and a natural rubber.” (emphasis added)

From the context of claim 11 reproduced above, it is apparent that the compound emphasized by underlining, i.e., “a hydrogenation product thereof”, means “a hydrogenation product of a copolymer comprised of vinyl aromatic monomer units and conjugated diene monomer units”. Therefore, the compound (1) above is a limitation to a compound recited in claim 11.

The compound (2) above is recited in claim 11. In order to show this, claim 11 is reproduced below again:

“11. The polymer foam according to claim 1 or 2, wherein said rubbery polymer as component (B) is at least one member selected from the group consisting of a 1,2-polybutadiene, a hydrogenation product of a conjugated diene homopolymer, a copolymer comprised of vinyl aromatic monomer units and conjugated diene monomer units and a hydrogenation product thereof, a block copolymer comprised of a homopolymer block of vinyl aromatic monomer units and at least one polymer block selected from the group consisting of a homopolymer block of conjugated diene monomer units and a copolymer block comprised of vinyl aromatic monomer units and conjugated diene monomer units and a hydrogenation product thereof, an acrylonitrile/butadiene rubber and a hydrogenation product thereof, an ethylene/propylene/diene rubber (EPDM), a butyl rubber and a natural rubber.” (emphasis added)

The compound emphasized by underlining, i.e., “a block copolymer comprised of a homopolymer block of vinyl aromatic monomer units and at least one polymer block selected from the group consisting of a homopolymer block of conjugated diene monomer units and a copolymer block comprised of vinyl aromatic monomer units and conjugated diene monomer units”, is the same as the compound (2) above.

The compound (3) above is also recited in claim 11. In order to show this, claim 11 is reproduced below again:

“11. The polymer foam according to claim 1 or 2, wherein said rubbery polymer as component (B) is at least one member selected from the group consisting of a 1,2-polybutadiene, a hydrogenation product of a conjugated diene homopolymer, a copolymer comprised of vinyl aromatic monomer units and conjugated diene monomer units and a hydrogenation product thereof, a block copolymer comprised of a homopolymer block of vinyl aromatic monomer units and at least one polymer block selected from the group consisting of a homopolymer block of conjugated diene monomer units and a copolymer block comprised of vinyl aromatic monomer units and conjugated diene monomer units and a hydrogenation product thereof, an acrylonitrile/butadiene rubber and a hydrogenation product thereof, an ethylene/propylene/diene rubber (EPDM), a butyl rubber and a natural rubber.” (emphasis added)

From the context of claim 11 reproduced above, it is apparent that the compound emphasized by underlining, i.e., “a hydrogenation product thereof”, means “a hydrogenation product of a block copolymer comprised of a homopolymer block of vinyl aromatic monomer units and at least one polymer block selected from the group consisting of a homopolymer block of conjugated diene monomer units and a copolymer block comprised of vinyl aromatic

monomer units and conjugated diene monomer units". This compound is the same as the compound (3) above.

Therefore, each of the Markush group members of claim 12 is a limitation to a compound recited in claim 11 or is recited in claim 11. Thus, claim 12 is properly dependent from claim 11, and the Examiner's objection should be withdrawn.

(V) Double patenting

Claim 1 is provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 2 and 5 of copending application No. 10/513,926 (see item 4 appearing at pages 3-4 of the outstanding Office Action). More specifically, the Examiner states as follows:

"In particular, the copending claims [relate to] a foam having a composition readable on claim 1 of instant invention, and the peak loss tangent and foam density are deemed to be obvious routine optimization, motivated by the desire to obtain a workable cushioning property. As to the optional limitation, since it is not required, it has not been given patentable weight."

Traverse is made as follows.

As explained above, the hydrogenated copolymer (A) used in the present invention has the above-mentioned feature (III) (i.e., the feature that at least one peak of loss tangent ($\tan\delta$) is observed at -40 °C to lower than -10 °C in a dynamic viscoelastic spectrum obtained with respect to the hydrogenated copolymer (A)). As explained above, feature (III) is essential for achieving a good balance of flexibility, low temperature characteristics (such as flexibility at low temperatures) and shock-absorbing property (low impact resilience) in the polymer foam.

On the other hand, copending application No. 10/513,926 discloses a hydrogenated copolymer (see claim 1 of the copending application). In the copending application, at least one peak of loss tangent ($\tan\delta$) is observed at -10 to 80 °C in a dynamic viscoelastic spectrum obtained with respect to the hydrogenated copolymer (see claim 1 of the copending application). The range (from -10 to 80 °C) of peak of loss tangent recited in claim 1 of the copending application does not overlap with the range (from -40 °C to lower than -10 °C) of peak of loss tangent recited in feature (III) of the hydrogenated copolymer (A) used in the present invention.

Also, the copending application aims at obtaining a hydrogenated copolymer having excellent properties with respect to abrasion resistance and flexibility, and the range (-10 to 80

°C) of peak of loss tangent recited in claim 1 of the copending application is essential for achieving the excellent abrasion resistance and excellent flexibility of the hydrogenated copolymer of the copending application. This is apparent from the following description of the copending application:

"The hydrogenated copolymer of the present invention, the first-order modified, hydrogenated copolymer of the present invention, the second-order modified, hydrogenated copolymer of the present invention, the hydrogenated copolymer composition of the present invention, the first-order modified, hydrogenated copolymer composition of the present invention, and the second-order modified, hydrogenated copolymer composition of the present invention are advantageous not only in that they are suitable for use as a foaming material, a building material, a vibration damping, soundproofing material, an electric wire coating material and the like, but also in that, when they are subjected to a crosslinking reaction in the presence of a crosslinking agent, there can be obtained crosslink products having excellent properties with respect to abrasion resistance, heat resistance and the like." (emphasis added) (see page 3, line 21 to page 4, line 12 of the copending application)

"The presence of at least one peak of loss tangent in the range of from -10 to 80 °C is essential for achieving a good balance of abrasion resistance and flexibility of the hydrogenated copolymer." (emphasis added) (see page 45, lines 16-19 of the copending application)

The copending application never teaches or suggests feature (III) of the hydrogenated copolymer (A) used in the present invention and the effects achieved by the use of it.

From the above, the Examiner's rejection should be withdrawn.

(VI) Rejection under 35 U.S.C. 101

Claims 7 and 8 are rejected under 35 U.S.C. 101 on the ground that the claimed invention lacks patentable utility (see items 5 and 6 appearing at page 4 of the outstanding Office Action). More specifically, the Examiner states that "throughout the specification, nowhere has the Examiner found a disclosure relating to the utility of the functional group of the modifier". However, as explained below, the utility of the functional group of the modifier recited in claim 7 or 8 is described in the present specification.

The Examiner's attention is drawn to the following description of the present specification:

“When the hydrogenated copolymer (A) is a first-order modified, hydrogenated copolymer or a second-order modified, hydrogenated copolymer, with respect to the modifier bonded to the hydrogenated copolymer (A) (i.e., the first-order modifier (in the case of the first-order modified, hydrogenated copolymer), or both the first-order modifier and the second-order modifier (in the case of the second-order modified, hydrogenated copolymer)), the functional group thereof not only is reactive to the polymer (B), an inorganic filler, an polar group-containing additive and the like, but also has a nitrogen atom, an oxygen atom or a carbonyl group, so that the interaction between the functional group of the modifier and the polar group of the polymer (B), inorganic filler, polar group-containing additive or the like is effectively exerted due to a physical affinity (such as hydrogen bond) therebetween, thereby enhancing the excellent properties of the polymer foam of the present invention. Such enhancement of the excellent properties of the polymer foam can also be achieved when the hydrogenated copolymer (A) is graft-modified as mentioned above.” (emphasis added) (see page 54, line 11 to page 55, line 7 of the present specification)

As seen from the above-reproduced passage of the present specification, by the use of the functional-group having modifier recited in claim 7 or 8, the excellent properties of the polymer foam of the present invention can be enhanced. In this connection, it should be noted that, as explained above, Example 7 of the present application uses polymer 3, which is a (first-order) modified, hydrogenated copolymer as recited in claim 7 or 8.

Therefore, the utility of the functional group of the modifier recited in claim 7 or 8 is described in the present specification and, hence, the Examiner's rejection should be withdrawn.

(VII) Rejection under 35 USC 102 and 103

Claims 1-4 and 13-15 are rejected under 35 U.S.C. 102(a) as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as being obvious over Karande et al. [WO 02/068529 A2] (see item 9 appearing at pages 5-6 of the outstanding Office Action). Also, claim 12 is rejected under 35 U.S.C. 103(a) as being obvious over Karande et al. [WO 02/068529 A2] (see item 10 appearing at page 6 of the outstanding Office Action).

Specifically, with respect to claim 1, the Examiner states as follows:

“Karande's invention relates to an article prepared from a blend comprising 0 to 50 w% of hydrogenated random styrene butadiene copolymer [page 3]. Foamed articles are used for various cushions and footwear including shoe soles, etc.”[page 11].

For claims 1 and 14, regarding component (A), Karande is silent about the weight ratio between the styrene and butadiene, the peak loss tangent and foam specific gravity of the foam. However, since Karande teaches generally the same subject matter for the same use, workable aforementioned characteristics are deemed to be either anticipated by Karande, or obviously provided by practicing the invention of prior art. As to the component (B), since it is optional, it is not a required limitation by the prior, and therefore it has not been given a patentable weight."

Traverse is made as follows.

As explained above, the polymer foam of the present invention contains the hydrogenated copolymer (A) having the above-mentioned features (I) to (III), which are important for imparting to the polymer foam excellent properties with respect to flexibility, low temperature characteristics (such as flexibility at low temperatures) and shock-absorbing property (low impact resilience).

On the other hand, WO 02/068529 A2 (hereinafter, frequently referred to as "Karande '529") discloses an article prepared from a blend containing 0 to 50 % by weight of a hydrogenated random styrene/butadiene copolymer (see page 3 or claim 1 of Karande '529). However, with respect to at least features (I) and (II) and the effects achieved by these features, Karande '529 has no teaching or suggestion, as explained below.

At the outset, the Applicants submit that Karande '529 has no teaching or suggestion about feature (I) (i.e., the feature that the copolymer block S (contained in the unhydrogenated copolymer from which the hydrogenated copolymer (A) is obtained by hydrogenation) is comprised of vinyl aromatic monomer units and conjugated diene monomer units and has a vinyl bond content of from 5 % to less than 40 % as measured with respect to conjugated diene monomer units) and the effect achieved by this feature. On this point, an explanation is given below.

With respect to the hydrogenated random styrene/butadiene copolymer used in Karande '529, Karande '529 has no description such that the hydrogenated random styrene/butadiene copolymer is obtained by hydrogenating an unhydrogenated copolymer containing at least one copolymer block S as recited in feature (I). On this point, a more detailed explanation is given below.

The polymer block S recited in feature (I) has the following two characteristics (I-1) and (I-2):

(I-1) S is comprised of vinyl aromatic monomer units and conjugated diene monomer units.

(I-2) S has a vinyl bond content of from 5 % to less than 40 % as measured with respect to conjugated diene monomer units.

Karande '529 has no description about a polymer block having the above-mentioned characteristic (I-1), i.e., a polymer block comprised of vinyl aromatic monomer units and conjugated diene monomer units. In this connection, it should be noted that the EXAMPLES of Karande '529 do not disclose a polymer comprising both vinyl aromatic monomer units and conjugated diene monomer units, let alone a polymer containing a polymer block comprised of vinyl aromatic monomer units and conjugated diene monomer units.

With respect to characteristic (I-2) of the polymer block S, Karande '529 has no teaching or suggestion about this characteristic. The reason for this is that Karande '529 has no description about a polymer block comprised of vinyl aromatic monomer units and conjugated diene monomer units and, hence, no information regarding vinyl bond content as recited in characteristic (I-2) can be obtained from Karande '529.

Therefore, it is apparent that Karande '529 has no teaching or suggestion about feature (I) of the hydrogenated copolymer (A) used in the present invention.

Further, the following should be noted. As explained above, feature (I) is important for enhancing the shock-absorbing property (low impact resilience) of the polymer foam. Such an effect achieved by feature (I) is never taught or suggested by Karande '529.

Thus, it is apparent that Karande '529 has no teaching or suggestion about feature (I) and the effect achieved by this feature.

Secondly, the Applicants submit that Karande '529 has no teaching or suggestion about feature (II) (i.e., the feature that the hydrogenated copolymer (A) has a content of the vinyl aromatic monomer units of from more than 40 % by weight to 60 % by weight, based on the weight of the hydrogenated copolymer (A)) and the effect achieved by this feature. On this point, an explanation is given below.

With respect to the hydrogenated random styrene/butadiene copolymer used in Karande '529, Karande '529 has no description about a specific range of the styrene monomer unit content of the hydrogenated copolymer. In this connection, it should be noted that the EXAMPLES of Karande '529 never disclose a polymer having a styrene monomer unit content within the range (more than 40 % by weight to 60 % by weight) recited in feature (II). Specifically, as polymers containing styrene monomer units, the EXAMPLES of Karande '529

discloses polymers EPS 1, EPS 2 and ES 1 (see pages 12-15 of Karande '529). The styrene monomer unit contents of these polymer are described in Table 1 appearing at page 15 of Karande '529, which shows that the styrene monomer unit contents of polymers EPS 1, EPS 2 and ES 1 are respectively 14 % by weight, 24 % by weight, 30 % by weight, none of which is within range (more than 40 % by weight to 60 % by weight) recited in feature (II).

Therefore, it is apparent that Karande '529 has no teaching or suggestion about feature (II) of the hydrogenated copolymer (A) used in the present invention.

Further, the following should be noted. As explained above, feature (II) is important for enhancing the polymer foam with respect to flexibility and shock-absorbing property (low impact resilience). Such an effect achieved by feature (II) is never taught or suggested by Karande '529.

Thus, it is apparent that Karande '529 has no teaching or suggestion about feature (II) and the effect achieved by this feature.

From the above, it is apparent that Karande '529 has no teaching or suggestion about at least features (I) and (II) of the hydrogenated copolymer (A) used in the present invention and the effects achieved by these features.

Incidentally, with respect to feature (III) (i.e., the feature that at least one peak of loss tangent ($\tan\delta$) is observed at $-40\text{ }^{\circ}\text{C}$ to lower than $-10\text{ }^{\circ}\text{C}$ in a dynamic viscoelastic spectrum obtained with respect to the hydrogenated copolymer (A)), Karande '529 never teaches or suggests that this feature is essential for achieving a good balance of flexibility, low temperature characteristics (such as flexibility at low temperatures) and shock-absorbing property (low impact resilience) in the polymer foam.

Thus, Karande '529 has no teaching or suggestion about the hydrogenated copolymer (A) having all of features (I) to (III) used in the present invention and the effects achieved by these features. The Examiner's rejection should be withdrawn.

(VIII) Conclusion

From the foregoing, it is firmly believed that the all of the Examiner's objections and rejections have been overcome. Early and favorable action is respectfully solicited.

Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

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